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4 March 1982

Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

No. 205

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MOSCOW LAO SERVICE ON NEW SATELLITE TERMINAL

BK111129 Moscow in Lao to Laos 1130 GMT 9 Feb 82

[Interview with Son Khamvanvongsa, vice minister of propaganda, information, culture and tourism of the LPDR, given to station correspondent "early this month"--place of interview not given, recorded]

[Text] [Question] Today I have the opportunity to meet Son Khamvanvongsa, vice minister of propaganda, information, culture and tourism. I would like to ask you, Mr Vice Minister, for your views on the report that construction of a satellite relay station being built by the LPDR with Soviet assistance will be completed soon. What are your views on the construction of this station, and what will it do for the Lao people? How significant is it to USSR-LPDR friendship? Please give us your views on these matters.

[Answer] Regarding this satellite relay station which is being built with Soviet assistance, the construction work began in 1978. The Soviet side has given assistance in the fields of funds and equipment. At the same time, Soviet engineers and technicians headed by Comrade (Paritov) assisted Lao engineers in preparing for the construction work. The preparatory work was completed in mid-1980; and the construction of the station began in late 1980. As of now, construction has been basically completed. It is expected that the satellite relay station will be officially handed over to Laos soon.

This station will provide many benefits. It will serve as an important instrument for telecommunications, postal, teletype, telephotographic and television links between Moscow and Vientiane, or between the Soviet Union and Laos in general. When functioning, the station will produce enormous benefits contributing to telecommunications, television and the other spheres I mentioned above.

It is certain that the Soviet assistance in building the relay station can be regarded as a contribution to the socialist transformation and construction in Laos. It will also contribute to the Lao people's telecommunications work. In addition, it is regarded as a contribution to the strengthening of the solidarity and friendship between Laos and the Soviet Union.

On behalf of the Ministry of Propaganda, Information, Culture and Tourism, which is assigned to utilize television via the satellite relay station, we would like to thank the Soviet Union for assisting in the construction work. We are making preparations to utilize the signal in our television network in the near future. I would like to extend our thanks through you to the (?Soviet technicians) for contributing to building the station.

CSO: 5500/2122

USSR BUILDS LAOS SATELLITE RELAY STATION

BK201034 Vientiane Domestic Service in Lao 0430 GMT 20 Feb 82

[Text] The satellite communications relay system (Antek-Sputnik), which the Soviet Union has been building for Laos, is now completed and installed. A test run shows that the station is fully operational. Its circuits are capable of handling telephone communications and relaying television programs from Moscow to Laos.

A ceremony to hand over the station officially was held on the morning of 19 February 1982. Presenting the station was Zunarev, Soviet deputy minister of posts and telecommunications, and Thammasin Saikhampan, acting minister of posts and telecommunications. Attending the ceremony were Sali Vongkhamsao, secretary of the LPRP Central Committee, vice premier and chairman of the National Planning Committee; several ministers and vice ministers; diplomats of the socialist countries; and a large number of cadres from various ministries and departments.

At the ceremony, the Soviet and Lao ministers delivered statements to officially hand over and accept the station. The two sides expressed mutual affection, friendship and fraternal cooperation. The Lao side expressed particular thanks and gratitude to the fraternal Soviet party, government and people for building the station as a gift for the Lao party, government and people. The representatives of the Soviet and Lao Governments signed an official document on the handing over of the station in the presence of all distinguished guests attending the ceremony.

On this occasion, Sali Vongkhamsao, representing the Lao party, government and people, presented a banner to Zubarev as a gesture of gratitude to the fraternal Soviet party, government and people and to praise the dedication and virtue of the Soviet experts who have collaborated with Lao technicians and workers to build the station successfully.

The construction of the relay station began in October 1980 in accordance with the Lao-Soviet agreement signed on 4 October 1978 and has been completed after more than a year of work. The station is composed of two satellite relay systems. The first system transmits to and accepts signals from the satellite, while the other relays those signals to and from Vientiane. Each system is equipped with a transmitter, a receiver and an antenna 32-meters in diameter. The antenna for relaying signals to and from Vientiane is 108 meters tall, while the one for relaying signals to and from the satellite is 78 meters tall.

With maximum utilization, the station is capable of simultaneously handling telephone communications through 12 channels and providing 144 channels for other forms of communications--telegraph, teletype and other telecommunications--and two channels for color television. It is capable of linking telecommunications with any country in the world through a country which also operates an (Antek-Sputnik) satellite relay station.

CSO: 5500/2122

BRIEFS

USSR, AUSTRIA BROADCASTING AGREEMENT--A long-term agreement on cooperation in the sphere of radio broadcastinb between the Soviet Union and Austria was signed in Vienna today. The agreement provides for the exchange of direct relays and special radio programs about key events in the lives of the Soviet and Austrian peoples and the exchange of recordings of musical work. On the Soviet side the agreement was signed by Mamedov, first deputy chairman of the USSR State Committee for Television and Radio Broadcasting, and on the Austrian side by Bacher, director general of Austrian Radio and Television. [Text] [LD111950 Moscow Domestic Service in Russian 1600 GMT 11 Feb 82]

USSR-DRA COMMUNICATIONS COOPERATION--Cooperation between the Soviet Union and the Democratic Republic of Afghanistan in the sphere of communications is developing successfully. The enormous silvery dish-aerial of a Lotos satellite communications ground station has transformed the panorama of the Afghan capital. This station has been built in Afghanistan under an intergovernmental agreement. Afghan assembly workers installed the aerial and erected the station building under the guidance of experienced Soviet specialists. Part of the materials for its construction was supplied from the Soviet Union. The complex equipment of the station was assembled and tuned by Soviet engineers who simultaneously trained their Afghan colleagues who are to man the station themselves. The Lotos installation will enable color TV programs to be received and transmitted and will ensure high-quality telephone and telegraph communications. This complex equipment will, via distant space, bring Afghanistan closer to the many fraternal countries of the world which are members of the Intersputnik International Organization and will promote the mutual understanding and cooperation of peoples. Test transmissions are already under way and the Lotos facility will be fully commissioned at the end of February. [Text] [LD140400 Moscow Domestic Television Service in Russian 1800 GMT 13 Feb 82]

TRANSMISSION SYSTEM IN SYRIA--SAT has just obtained a contract for 35 million francs to install in Syria a 140 Mbits/sec digital transmission system, to operate on a coaxial cable available between Damas and Alep on one hand, and Tartous-Lattaquie on the other. These connections should be placed in service during the summer of 1983. The equipment used is second generation MIC (coded pulse modulation). They will increase the capacity of these lines--which are longer than 600 km--to 1920 telephone connections. In addition, the Tartous connections bolster the capacity of international circuits, in particular for telephone connections with France. [Text] Paris ELECTRONIQUE ACTUALITES in French 22 Jan 82 p 6 11,023

CSO: 5500/2105

SATTAR SPEAKS AT OPENING OF SATELLITE STATION

Dacca THE BANGLADESH OBSERVER in English 27 Jan 82 pp 1, 16

[Text] President Mr. Justice Abdus Sattar said that a standard and effective telecommunication system was a pre-requisite for the successful implementation of a country's development programme.

President Sattar while inaugurating the country's second satellite earth station at Talibabad near Kaliakair, Dacca on Tuesday said that it was necessary to improve the telecommunication system of the country with outside world.

The Minister for Posts, Telephones, Telegraphs, Civil Aviation and Tourism Mr. A. K. M. Mayedul Islam, Mr. Loic Moreau, the French Ambassador in Bangladesh and Mr. A. B. M. Taher, Chairman, T & T Board also spoke on the occasion.

Stressing the importance of telecommunication system, the President said that it was vital for the success of administration, expansion of internal and external trade, development of agriculture and industries and improvement of socio-cultural condition of the country.

President Sattar asserted that late President Ziaur Rahman felt the necessity of setting up of this station to expand the international telecommunication network and to use it as an alternative to Betbunia in time of emergency. This project was implemented because of the sincere efforts of the late President, he added. President said late President Zia also felt the importance of telecommunication system in building up the economic infrastructure of a nation.

With the beginning of civilisation communication was maintained between far-flung areas through sound signal and now it has turned into improved telecommunication system through the satellite, the President observed.

President Sattar remarked that the telecommunication system through the satellite has brought the world closer. He said what was a dream a few years had now turned into a reality.

President Sattar thanked the French Government for its assistance in setting up of this station. He also thanked the local engineers and technicians of the T & T Board for completing work of design and specification without the help of any foreign experts.

Mr Mayeedul Islam said that keeping in view of the importance of maintaining telecommunication link with different countries this station had been set up as an alternate to Betbunia satellite station.

The Minister said that late President Zia had desided that Bangladesh should go ahead in the field of international telecommunication in line with other advanced countries. The first satellite station was set in Betbunia in 1975. And with the rapid expansion of international telecommunication system it was felt necessary to set up this station Mr Maveedul Islam remarked.

The Minister said with the commissioning of this station the country would be able to maintain telecommunication link with the neighbouring countries and telecommunication link with Italy and Hong Kong had already been made on trial basis he said. Besides maintaining telephone, telegraph and telex service this station will also receive television programmes of different countries and despatch Bangladesh's programmes to other countries he observed.

Mr. Mayeedul Islam mentioned that the station had been set up at a cost of Taka 11.30 crore including a foreign exchange component of Taka 4.60 crore. He said that with a view to easing the 10nd of the international telecommunication system an international trunk exchange would be set up.

The French Ambassador said that the importance of telecommunication system to help the growth of industrial and commercial resources and to extend communications and relations at national and international levels was immense.

The function was attended by the members of the Council of Ministers members of the diplomatic corps and elite of Dacca city.

CSO: 5500/7079

ITU SECRETARY GENERAL TALKS TO DACCA PRESS

Dacca THE NEW NATION in English 31 Jan 82 pp 1, 8

[Text] The secretary General of International Telecommunication Union (ITU), Mr. M. Mili said yesterday he was impressed with the 'vast possibility and long experience' achieved by Bangladesh in manufacturing "high quality" telecommunication equipment, reports BSS.

Mr. Mili was talking to newsmen at Zia International Airport; prior to his departure concluding a four-day visit to Bangladesh.

Mr Mili said he visited a number of telecommunication installations and equipment manufacturing units during his stay here.

He said the installations showed the extent of development in telecommunication, while the industries demonstrated that Bangladesh was able to produce the equipment comparable to those in any developed country.

Mr Mayeedul Islam, Minister for Posts, Telegraphs, Telephones, Civil Aviation and Tourism saw Mr. Mili off at the airport.

Mr Mili said that many Islamic countries which import telecommunication equipment from different countries could also do it from Bangladesh having capability to produce them for export.

He said cooperation among these fraternal countries was essential for their development and progress. He added that he would discuss this with these countries.

The Secretary General, who also visited the National Broadcasting Academy and the television centre said he had "deep discussions" for their further development. I will love to do anything to help further develop broadcasting and TV here in cooperation with UNESCO.

He also discussed the possibility of setting up a high level training institute here for telecommunication engineers, Mr. Mili added.

The telecommunication installations which he visited here including the earth satellite station at Talibabad he said were all very modern providing the country with a fairly good telecommunication system.

CSO: 5500/7081

BANGLADESH

BRIEFS

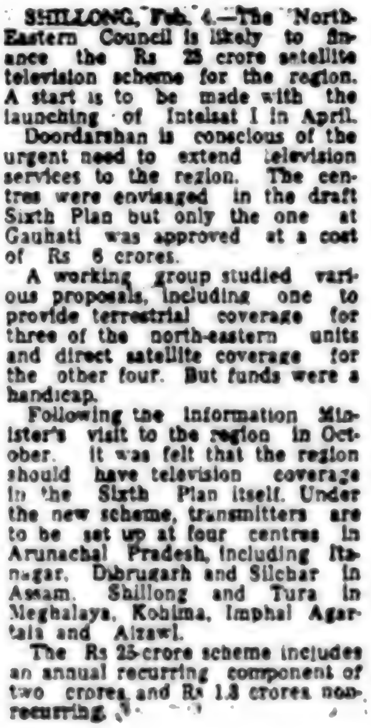
ITU OFFICIAL CALLS ON PRESIDENT--The visiting Secretary-General of the International Telecommunication Union (ITU) Mr Mohammad Mili called on President Abdus Sattar at Bangabhaban on Thursday morning, reports BSS. Post Telephone and Telegraph Civil Aviation and Tourism Minister Mr. A. K. M. Mavedul Islam was present on the occasion. Mr. Mohammad Mili had a meeting with the Minister for Posts Telephones and Telegraphs Civil Aviation and Tourism Mr Mavedul Islam in Dacca on Thursday morning. The Minister informed the ITU chief that a proposal had been submitted to the Organisation of Islamic Conference for setting up of the telecommunication manufacturing complex in Bangladesh. The ITU he said could be of great assistance in implementing this modern complex. Mr Mili appreciated this venture and said that ITU cooperation in this field would be looked into. Emphasising the need for improvement of telecommunication system the Minister said that improved quality of manpower is a prerequisite to better service to the people. Development of modern telecommunication was needed both for accelerated development of a country and effective communication with outside world, he added. The meeting also hoped that the areas of further cooperation between ITU and Bangladesh would be identified during the visit of ITU chief to Bangladesh. ITU has rendered assistance in three on-going projects in the country namely Telecommunication Training Centre assistance to broadcasting development and Telecommunication Staff College with financial assistance of UNDP. The Resident Representative of UNDP Mr W. Halzhausen, Mr S. N. Rahim head of Asia Pacific Division of ITU and the Chairman T & T Board including senior officials of the Ministry participated in the meeting. [Text] [Dacca THE BANGLADESH OBSERVER in English 29 Jan 82 pp 1, 12]

CSO: 5500/7080

NORTHEAST COUNCIL CONSIDERS TELEVISION OUTLAY

Calcutta THE STATESMAN in English 6 Feb 82 p 13

[Excerpt]



SHILLONG, Feb. 4.—The North-Eastern Council is likely to finance the Rs 25 crore satellite television scheme for the region. A start is to be made with the launching of Intelsat I in April.

Doordarshan is conscious of the urgent need to extend television services to the region. The centres were envisaged in the draft Sixth Plan but only the one at Gauhati was approved at a cost of Rs 6 crores.

A working group studied various proposals, including one to provide terrestrial coverage for three of the north-eastern units and direct satellite coverage for the other four. But funds were a handicap.

Following the Information Minister's visit to the region in October, it was felt that the region should have television coverage in the Sixth Plan itself. Under the new scheme, transmitters are to be set up at four centres in Arunachal Pradesh, including Itanagar, Dibrugarh and Silchar in Assam, Shillong and Tura in Meghalaya, Kohima, Imphal Agartala and Aizawl.

The Rs 25-crore scheme includes an annual recurring component of two crores and Rs 1.8 crores non-recurring.

CSO: 5500/7078

FIBER OPTICS TRANSMISSION SYSTEM TESTED

OW171335 Tokyo KYODO in English 1245 GMT 17 Feb 82

[Text] Tokyo, 17 Feb (KYODO)--Japan has successfully conducted a field trial of a submarine, repeater-equipped long-distance fiber-optics transmission system, it was announced Wednesday.

The Governmental Nippon Telegraph and Telephone Public Corporation (NTT), which conducted the trial, said the success means Japan has taken a big step toward putting a long-distance submarine fiber-optics communication system into practical operation.

An NTT spokesman said the corporation would continue research on the system so that it may be put into practical use between Southern Kyushu and Okinawa, a distance of 1,000 kilometers, by fiscal 1985.

The spokesman said submarine fiber-optics cables totaling 45 kilometers in length were laid late last month on seabed at depths up to 1,000 meters off Yahatano on the east coast of the Izu Peninsula, southwest of Tokyo, by the submarine cable-layer Kuroshio Maru. The two repeaters are 15 and 30 kilometers apart on a cable loop. The system has a transmission rate of 400 megabits and is of single-mode type, the spokesman said.

He said as a result of the test, it was confirmed that high-speed digital signals, equivalent to 5,760D telephone circuits, could be accurately transmitted by the system over a 45-kilometer distance in a rigorous submarine environment.

The spokesman said that a short-haul nonrepeatered submarine fiber-optics transmission system field trial was successfully conducted by NTT in 1980.

Submarine fiber-optics cables totaling 10 kilometers in length were then laid from Inatori to Kawazu along the east coast of the Izu Peninsula, near the site of the latest trial.

The transmission system tested at that time consisted of submarine fiber-optics cables with repeater equipment at both shore terminal stations, but without any submarine repeaters, he said.

The spokesman said that in Britain, an 8-kilometer nonrepeatered submarine fiber-optics transmission system of the 140-megabit type was tested in May 1980.

CSO: 5500/2122

LAOS

BRIEFS

GROUND STATION--Vientiane, 19 Feb (TASS)--A ground station of the "Intersputnik" system of space communication was put into operation near the Laotian capital today. It ensures reliable telephone and telegraph communication and also reception of television programs from the USSR and other socialist countries. Called "Lotus," the station is a gift from the Soviet Union to the Laotian people. The station's big importance for Laos was noted at a meeting devoted to the completion of its construction. [Text] [LD200700 Moscow TASS in English 1700 GMT 19 Feb 82]

CSO: 5500/2122

BRIEFS

PESHAWAR TV CENTER--The opening ceremony of the newly built Pakistan television center at Peshawar is being formally performed on 18 February. The first phase of the 180 million rupee project has been completed at a cost of 108 million rupees. It is the fourth center of the country equipped with modern machinery with the facility of telecasting both colored and black and white programs. [BK180631 Karachi Domestic Service in English 1700 GMT 17 Feb 82 BK]

CSO: 5500/5686

BRIEFS

COMMUNICATIONS GROUND STATIONS--Bogota--Three new ground stations that will boost development in three national territories of the eastern and southern parts of the country, an area of 194,260 sq km, will begin operations by mid-1982. The stations, which will have the necessary equipment for satellite communications, will be built in Puerto Leguizamo in Putumayo, on the border with Ecuador and Peru; in (Puerto Imirida) in Guainia, on the border with Venezuela; and in [name indistinct], on the border with Venezuela and Brazil. Studies will also be undertaken on the acquisition of four additional stations, which will complete the border plan included in the national rural communications project. [PA250332 Bogota Domestic Service in Spanish 1730 GMT 23 Jan 82]

CSO: 5500/2121

BRIEFS

RADIO STATION ANNUAL EVALUATION--Antonio Perez Herrero, alternate member of the Politburo, has presided over the annual assembly meeting to evaluate the year's accomplishments of the "Radio Reloj" station. Also present was Jose Ramon Fernandez, member of the Central Committee and vice president of the Council of Ministers. In summarizing the results, Fernandez said that the profit making motives which gave "Radio Reloj" its start 35 years ago underwent a radical change after the triumph of the revolution. He added that "Radio Reloj" has become an indispensable medium for any person interested in keeping up with the news and at the same time serves as a valuable organ to disseminate the achievements of the revolution. Also presiding at the assembly were Nivaldo Herrera, president of the ICRT [Cuban Institute of Radio and Television], Victor Manuel Gonzalez, deputy chief of DOR [Department of Revolutionary Orientation], and Omar Mendoza, director of "Radio Reloj." [Text] [FL031800 Havana Domestic Service in Spanish 1100 GMT 3 Feb 82]

CSO: 5500/2124

BRIEFS

VENEZUELAN JAMMING DENIAL--The Venezuelan Ambassador to Guyana, Sadio Garavini, has denied that any Venezuelan electronic network was deliberately jamming Guyana's radio station in the Barima-Waini region. Mr. Garavini said there was "no reason to jam any station" in Guyana. He said that such action would be stupid. Residents of the Barima-Waini region had complained that their receiving sets were often intruded upon by Venezuelan stations at times when their dials were set for the Guyana Broadcasting Corporation. Residents claimed that most of the jamming took place whenever a newscast came on. [Text] [Georgetown GUYANA CHRONICLE in English 16 Jan 82 p 9]

CSO: 5500/7520

BRIEFS

TV RELAY STATION COMMISSIONED--According to the Central News Unit, the Bastak television relay station in Hormuzgan Province is now operating on the auspicious occasion of the 3d anniversary of the Islamic revolution. The 10 kilowatt relay station boosts the first network's picture on channel three. In addition to Bastak, nearby villages are also benefitting from the new station. [Text] [LD141850 Tehran Domestic Service in Persian 1630 GMT 14 Feb 82]

CLANDESTINE CLAIMS TELECOMMUNICATIONS CUT--Voice of Iran correspondents in London, Paris and Frankfurt have reported that all telephone and telex connections with Iran have been out since Tuesday morning. Our correspondents consider this connected to the rumors on Khomeyni's [word indistinct] illness and even his death and, quoting telecommunications engineers, they add that for some time now telephone and telex contacts with Iran have been difficult, but this time apparently the ruling mullahs have ordered a complete severence of the lines. The Voice of Iran correspondent in Frankfurt adds that West Germany's international telephone operators have described the way Iran's contacts with abroad have been severed as unprecedented since Bani-Sadr and Rajavi fled to Paris. [Text] [NC181135 (Clandestine) Voice of Iran in Persian 0330 GMT 18 Feb 82]

CSO: 5500/5329

NAKURU TO GET STD PHONE LINK

Nairobi DAILY NATION in English 28 Jan 82 p 4

[Text]

NAKURU will this year get the Subscriber Trunk Dialling (STD) system. Residents of Nakuru and outlying areas will be able to ring to any destination direct when the automatic telephone switch is finally installed.

The Posts and Telecommunications Corporation's divisional manager, Mr. Aggrey Omukuba told the *Nation* in an interview.

The residents have complained for long about the problems they face when trying to ring outside the town.

Mr. Omukuba said the machine will be installed at the end of the year

The project has received an additional grant from the World Bank, he added.

Already, the construction of the final extensions of Telephone House, Nakuru, where the machine and other switching gear will be installed has started.

Mr. Omukuba declined to say how much money would be pumped into the project

Asked why the STD facility had taken so long to instal, he said 1982 had been the "planned time" and it was "right on schedule."

The STD was part of the entire Pan African Telecommunication's network financed mainly by the World Bank and Kenya did not have full discretion on when and where to install it he said.

He also said the present telephone facilities installed more than 20 years ago were not enough. He agreed that the delay of an STD facility had given people problems because of the fast growing population in the area

Nakuru residents have often wondered why smaller towns had the facility while the town, the fourth largest in the country did not have any

CSO: 5500/5690

BRIEFS

'VOK' TO EXPAND--The Minister for Information and Broadcasting, Mr. Oloo Aringo, has said that plans were under way to introduce regional radio stations to cater for diverse cultural groups in the country. [Text] [Nairobi DAILY NATION in English 22 Jan 82 p 32]

WORLD AUDIENCE FOR VOK--Kenya's radio braodcast will be heard the world over when the 250 kilowatts transmitting station is completed at Koma Rock near Machakos. This was stated by the Permanent Secretary for Information and Broadcasting, Mr. Joseph Wairagu, at a meeting of heads of departments at the Lamu District headquarters on Thursday. Mr. Wairagu said that this would be a short-wave transmitting station. Some medium-wave transmitters were being set up at Voi and Garissa. Regarding television, Mr. Wairagu said that district will start receiving transmissions after completion of the post office microwave network which was behind schedule. On his way to Lamu, the PS visited development projects at Witu and Mpeketoni. Mr. Wairagu said he was impressed by their high standard of farming. He called for continuous interaction between researchers and farmers so that farmers could apply the best farming techniques. [Text] [Nairobi DAILY NATION in English 16 Jan 82 p 5]

CSO: 5500/5690

LTC BEGINS REHABILITATION, EXPANSION PROGRAMS

Monrovia NEW LIBERIAN in English 2 Feb 82 pp 3, 6

[Text] The Liberia Telecommunications Corporation (LTC) has begun rehabilitation and expansion programmes designed to improve telecommunications network throughout the country.

Disclosing this in an interview last Friday, LTC Managing Director, Charles B, Roberts,Jr., said under the programmes, the earth station circuit capacity is being upgraded to 60 circuits.

He said the First National City Bank has provided a short-term loan for this development, while construction of this project is being undertaken by the manufacturer of the equipment, Digital Communications Company (DCC) of the United States.

The Managing Director said in the rural areas of Liberia, where it is not economically feasible to provide public telephone network due to limited commercial facilities and public power system, coin telephone and dial long lines (DLL) stations have been installed to provide communications services.

The majority of these stations, he added, are essential to the administrative needs of government regardless of profitability.

He revealed that an international telephone exchange with an ultimate capacity of 4,000 circuits initially equipped with 30 circuits was installed by LM Ericsson of Sweden to operate regional and international telephone traffic.

Mr. Roberts said negotiations are also underway for LM Ericsson to expand the Exchange facilities in anticipation of the increasing demand for international circuits and automatic dialing facilities.

Pan African Telecom

The Managing Director also disclosed that a multi-channel trunk transmission network provided through a loan from the United States Agency for International Development (USAID) now links Monrovia with Harper in the south-east of the country.

The links also extends from Harper to Tabou in the Ivory Coast and forms part of the Pan African Telecommunications Network on the south eastern end of Liberia.

In order to meet the manpower requirement of the expanding telecommunications system within the country, the Managing Director said the corporation has intensified its staff training programmes to produce an adequate number of qualified engineers, technicians and professional staff.

Mr. Roberts expressed the hope that the Liberia Telecommunications Corporation will enhance its efficiency and profitability on completing of the rehabilitation and expansion programmes currently in progress.

He said an amount of $24 million will be required to finance the next phase of the corporation's expansion programme approved by the Board of Directors.

CSO: 5500/5687

NIGERIA

BRIEFS

NEW RADIO TRANSMITTER--Ikeja, 11 Feb (NAN)--The construction of the 1-million naira broadcasting transmitter for the Lagos Broadcasting Corporation has been completed. A statement issued today in Ikeja by the state government said that the transmitting station located at Itamaja in the Ikorodu local government included separate buildings for the corporation's radio and television transmitters as well as engineers' residential quarters. The transmitter, which was built by the State's Works Management Board, would replace the transmitter of the Federal Radio Corporation of Nigeria being used by the corporation. The new station will be commissioned on Saturday by Governor Lateef Jakande. [Text] [AB120855 Lagos NAN in English 0835 GMT 12 Feb 82]

FRCN BILL WITHDRAWN--Mr. E. C. Eboh of the NPP has expressed his unhappiness at the withdrawal of the FRCN bill by President Shehu Shagari. The legislator was happy at the presentation of the FRCN Bill by the President. A member of the dissolved Constituent Assembly, Mr. Eboh said the bill did not touch the original functions of FRCN. Instead it was only an attempt to give FRCN greater coverage in the states. He then explained that the bill was to make it possible for the Federal Government to have direct communication with the states connecting the grass roots. Furthermore, he added that there would be Federal presence in the states and would allow for expansion for the workers of the corporation. With this new bill the old order of regionalism in the country would be forgotten, he added. Mr. Eboh then said that then every state would be equal to one another and one would not be subordinate to the other. [Banke Odutayo] [Text] [Lagos SUNDAY TIMES in English 7 Feb 82 p 32]

CSO: 5500/5691

BRIEFS

LUSAKA RADIO RECEPTION--Reception on Radio Zambia is expected to improve soon when valves imported from China for the shortwave transmitters are installed and transmitters start working on full power. The valves, which arrived in the country last week, have a life span of about 600 transmission hours every day and more than 600 hours a month. Permanent secretary in the Ministry of Information and Broadcasting, Mr (Edward Lubinda), confirming the arrival of the valves, said his ministry needs more valves and would ask for more from the suppliers. Mr (Lubinda) also said that the supply of more values will be subject to discussion between Zambia and the Chinese Government. The permanent secretary said about half of the consignment of the transmitters valves arrived, but could not give the exact number of valves. [Text] [CA090206 Lusaka Domestic Service in English 0500 GMT 8 Feb 82 CA]

CSO: 5500/5685

PHONE CONNECTIONS WITH DENMARK IMPROVED BY SATELLITE

Godthaab GRONLANDSPOSTEN in Danish 27 Jan 82 p 8

[Text] Next year telephone connections between Greenland and Denmark will improve substantially according to the Postal and Telegraphic Service (P & T) in Denmark. At that time a satellite ground station with Blavand Radio is expected to be ready and from there telephone and telex traffic can be guided via satellite to the system of ground stations already established in Greenland.

For users the Blavand Radio satellite ground station means it will be much easier to call to and from Greenland. Today there is usually a waiting period if one wants to call from Greenland to Denmark while calls going the other way can go through immediately if one calls National Telephone.

The system's capacity will be much greater than the present connection which goes over the joint Nordic satellite ground station in Tanum, Sweden. The quality of telephone connections will also improve. In the present system all calls to and from Greenland go over Nuuk.

But the internal Greenland telephone network has connections via satellite with ground stations in several towns in Greenland and in the future these stations can handle calls directly to and from Denmark.

Cheaper Rate

The need for telecommunications between Greenland and Denmark has risen sharply and it is expected to rise even further after the just completed expansion of the Greenland network. This is a system of ground stations--known as the Inuksat [expansion unknown] system--that completes connections via satellite.

With the establishment of the Blavand Radio ground station it is also expected that there will be a transition to direct dialing to and from Greenland.

Today it is more expensive to call from Denmark to Greenland than from Denmark to the United States. With direct dialing and the new connection a rate decrease would be called for. The amount of the decrease must be negotiated between GTO [expansion unknown] and P & T.

6578
CSO: 5500/2114

GREENLAND ENTERING TELEVISION AGE WITH GODTHAAB NET CENTER

Godthaab GRONLANDSPOSTEN in Danish 20, 27 Jan 82

[20 Jan 82 p 10]

[Text] TV in Greenland

Starting on 1 November TV in Greenland will be broadcast from a central location in Nuuk. It will also be possible to produce Greenland programs and broadcast them while events are taking place.

For an individual direct TV will mean an extra charge in the form of an increase of less than 30 kroner a month in payments to TV societies. In return viewers can look forward to TV news and children's programs produced in Greenland. They can also feel good about the fact that programs will be broadcast legally, in contrast to current practice.

The primary factor behind the introduction of Greenland television is to halt the illegal taping of Danish TV currently practiced by the country's 25 local TV societies.

Greenland Enters TV Age

Recently it has been quite hard for workers at station KNR in Nuuk to think clearly. Radio House on H. J. Rinksvej has resounded to the noise of rumbling and hammering that at times even penetrated the soundproof studios.

The noise comes from drills and pneumatic hammers in the hands of workers who are transforming the former concert hall into a TV studio. From here it will be possible to broadcast in the native language by sometime in 1982 to the 25 towns and villages along the coast that have a TV society. A new feature is that it will be possible to transmit events while they are taking place.

But the most important thing is that all Greenland will be looking at the same TV picture. Starting 1 November it will no longer be possible to view programs the TV societies have taped illegally from Danish television for rebroadcast later through their own local networks.

"The primary thing about introducing direct TV is that it will put an end to the illegal conditions," said radio chief Peter Frederik Rosing with the buzz of a pneumatic hammer penetrating to his office. "The second most important thing is that we will be able to produce some broadcasts ourselves and supply Danish programs with Greenlandic subtitles.

Hot Potato

"The hot potato in the matter involves copyrights," continued the radio chief. "Greenland must have an agreement with artists, musicians, technicians and others who work on the broadcasts produced in Denmark so that they receive the payment due them. They have been cheated on this by Greenlanders in the past."

The Greenland contribution will be pegged to the number of viewers and will run to around several hundred thousand kroner a year. Negotiations will start very soon with interest organizations concerning the exact amount. The money will be distributed to the proper recipients by Danish Radio which already pays out 50 million kroner a year for copyright material.

TV News and Children's Programs

Even though direct TV will be introduced that doesn't mean the end of seeing Danish programs. The initial objective is to include a TV news broadcast and some children's programs in the Greenland share of the daily broadcast time of 4 or 5 hours. That's all they can handle with a total TV staff of eight, including two journalists.

The programs will reach the viewers via the UHF system which has two lines. One is now used for telephone, telegraph and telex connections while the other serves as a reserve in case of breakdown or repairs.

It is the reserve line that will now be used to transmit TV. It will be leased by the Telecommunications Agency for 2.5 million kroner a year--a sum viewers will pay for through fees paid to their local TV societies.

The extra payment will be the same whether the viewer lives in Nanortalik or Nuuk. The uniform-price principle means that all viewers will pay 30 kroner more a month for the service.

But that is a gross figure, emphasized the chairman of the Federation of TV Societies, FTV, head teacher Mogens Bloch Poulsen in Qasigiannguit:

"Direct TV means that the societies can save some money. For example it will not be necessary as it is now to have a man locally to supervise program broadcasting at all times. In addition there won't be the expenses of taping TV shows in Denmark. Therefore I don't think the extra fee will be more than 20-25 kroner a month."

The final introduction of Greenland TV will occur toward the end of the year. But a trial line will be set up in June from Nuuk to Maniitsoq, Kangamiut, Sisimiut and Kangerlusuaq.

[27 Jan 82 p 14]

[Text] Satellites Above Us

Foreign television can deal a death blow to Greenland's TV according to radio chief Peter F. Rosing.

In just a few years it will be possible to receive around 30 TV programs in color in Greenland from satellites. This information came from an executive committee meeting of the Federation of Greenland TV Societies held this fall in Kangerlussuaq.

It is already technically possible today to receive foreign programs from space for a modest investment of 15-20,000 kroner. This opens up a number of possibilities for Greenland viewers. But at the doorway to this brave new world there are also a number of new problems.

"Satellite TV is an alternative," said radio chief Peter F. Rosing. "But it must be introduced with due consideration. Otherwise it could be a death blow to the societies belonging to FTV.

"I oppose restrictions but it is clear that some control is needed here. We must make sure that satellite programs don't choke publicly-run radio and TV.

"But the question is how long it can be kept out. When we get to the point where an antenna on the roof of a home can receive satellite signals it will be useless to try to do anything about it."

Milder Rules

FTV chairman, head teacher Mogens Bloch Poulsen of Qasigiannguit also thinks satellite TV should be introduced with reservations.

"As legislation stands today anyone can put up a parabola antenna and receive signals. But in contrast to Denmark the signals may not be shared with family and neighbors."

The FTV chairman thought a possible solution would be to give the TV societies special permission to broadcast satellite signals.

"But then the question is which programs to choose. With regard to this point there are a number of political decisions that have not yet been made," he said.

In order to give politicians a basis for issuing some guidelines a report on the possibilities of satellite TV is currently being prepared. It is expected to be ready in both Danish and Greenlandic by fall.

"We in FTV hope that the rules can be softened up a little so that individual towns in Greenland can get permission to bring down satellite signals.

Cultural Policy Danger

"In principle we are especially interested in signals from Canada," said Mogens Bloch Poulsen. "Broadcasts in the Eskimo language are transmitted to many towns over there. In that way we could increase our contacts with people on the other side of the Davis Strait."

Doesn't satellite TV represent a cultural policy danger?

"Very much so. That is why some guidelines must be established when a TV program committee is appointed in March or April. These ethical guidelines should apply to everything transmitted--local broadcasts as well as satellite signals. That would prevent the worst things from reaching the viewers. For example we are not much interested in the American programs--they're a little too rough, contain too much violence."

But if satellite receivers get a little cheaper it would be hard to prevent an individual household from bringing in a signal, wouldn't it?

"Right. Just as one can't prevent people from receiving radio signals. But it's probably too much to believe that antennas will be erected on all the roofs in Greenland. In the first place viewers would have to invest in a new TV set because Americans and Canadians use a different system. Then it needs an antenna. All in all it would add up to quite a sum."

6578
CSO: 5500/2114

BRIEFS

TRANSMITTERS FOR A SOUTHEAST ASIAN ARMY--Thomson-CSF has just been awarded a contract of the order of 100 million francs to supply portable TRC 340 HF/BLU transmitters-receivers for the armed forces of a Southeast Asian country whose name was not disclosed. The TRC 340 (1.5 to 30 MHz and 20 W) can be used while carried by a man or as a detachable mobile unit. It belongs to the new family called Serie Thomrange, and can be coupled with 100 and 400 W amplifiers to become power transmitters. Thomson-CSF has announced in this respect, the sale of several thousand sets in this product line during the last six months. [Text] Paris ELECTRONIQUE ACTUALITES in French 15 Jan 82 p 8 11,023

CSO: 5500/2105

SINGLE-CHIP PCM VOICE CODEC IN NMOS TECHNOLOGY

Milan ALTA FREQUENZA in English Nov-Dec 81 pp 294-301

[Article by G. B. Galimberti, Rinaldo Poluzzi, Giorgio Baccarani and Bruno Ricco]

[Text]

Abstract. A single-chip PCM voice CODEC has been designed and manufactured in n-MOS technology, resulting in a compact, low-cost device. Power consumption has been kept at a minimum adopting only two ± 5 V supplies, and making use of fully capacitive, charge redistribution, digital-to-analog converters (DAC). The chip implements the A compression law and its performance is shown to exceed the CCITT specifications.

1. INTRODUCTION

In recent years, a great deal of effort has been concentrated on the realization of telecommunication circuits in the form of silicon monolithic components. Among these, the most important one so far appeared on the market is that performing the analog-to-digital and digital-to-analog conversions (CODEC) on the PCM telephone signals, with the channel low-pass PCM filter and the subscriber-line interconnection circuit (SLIC) also being of major interest.

While for the latter of these no commercially available device has so far been announced (universally accepted standards for its specifications have still to be fixed), the others have already been successfully realized [1-8] so that the next really innovative target has now become a single chip containing both the CODEC and the filter.

With regard to the CODEC, the efforts devoted to its realization have recently been so intense, that almost all the semiconductor companies have been active in developing their own project. This justifies the large number of devices so far appeared on the market [9], most of which are based on different solutions concerning system architecture, circuit design, and tecnology.

To day it can, however, be confidently said that two of them, both implementing the system choice of single-chip per-channel devices, have rather firmly established themselves as the most successful ones. These are realized in n-MOS [2] and C-MOS [1] technologies, respectively. As a consequence, the former occupies a smaller silicon area, though including the interface logic to a microprocessor, and the result is intrinsically cheaper and more suitable for being integrated together with the filter (1). On the other hand, the C-MOS device has some distinct advantages as far as power consumption is concerned, a point of major importance in the densely packed PCM transmission systems but, perhaps, far less important in switching networks.

In this paper we present a new per-channel CODEC which has been realized in n-MOS technology. It employs two separate digital-to-analog converters (DAC) for the transmit and receive operations, in order to ensure an excellent system isolation. The DAC's are fully capacitive [10,11] and work on the basis of the charge redistribution principle. Such a solution eliminates the need of external sample-hold capacitors and filtering networks for auto-zeroing, and appreciably reduces power consumption. The latter has been minimized by using only two ± 5 V supplies, by carefully designing the CODEC linear circuits (operational amplifier and comparator) and by implementing the companding/expanding interface to the linear DAC's by a tree-like, transmission gate chain.

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(1) It is worth pointing out, however, that such a consideration might no longer hold with the introduction of high-density silicon-gate C-MOS technologies.

The result is a low cost, low power (70 mW typical) device, suitable for the future integration of the channel filters on the same chip.

The structure and timing are described in sections 2 and 3, respectively. Section 4 specifies the features of the A law mostly used in Europe, and section 5 contains the circuit description of the various blocks, namely the DAC, the successive approximation register (SAR), the expander, the operational amplifier and the comparator. The circuit performance is illustrated in section 6, and conclusions are drawn in section 7.

2. SYSTEM DESCRIPTION

As schematically shown in figure 1, the chip is divided in two parts which are completely separated from one another, so as to achieve the best conditions for asynchronous behaviour of the transmit and receive sections as well as for minimizing crosstalk, distortion and noise.

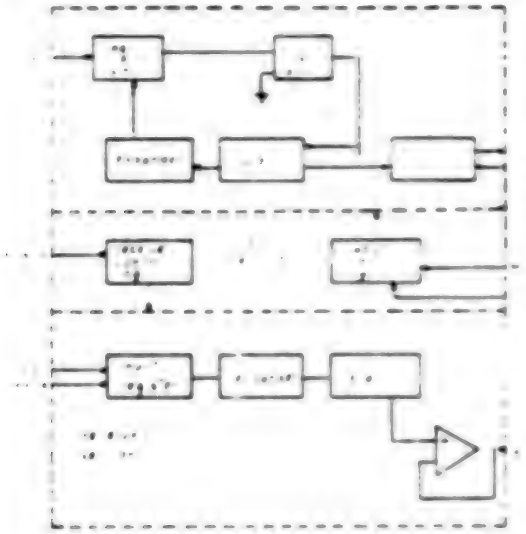

Fig. 1 - Block diagram of the CODEC implementation.

The receive section, besides its control logic, consists of four main blocks: 1) an input register, where the incoming 8 bit digital signal is serially loaded at the system rate of 2 Mbit/sec and is then extracted in parallel at the sampling frequency of 8 KHz; 2) an expander circuit, to be found in the transmit section as well, which translates the digital input word into a linear code. The need for such a circuit stems from the fact that the adopted DAC is intrinsically linear, as will be made clear in section 5; 3) the DAC; 4) an output buffer which is implemented by an operational amplifier connected in the unity-gain configuration.

The transmit section consists of the following blocks. A fully capacitive DAC, performing also the sample-hold operation on the incoming analog signal V_{in}. Such a circuit is driven by the successive approximation register (SAR) through an expander which, again, translates the compressed conversion law into a linear code. The SAR supplies, in strategic order, the various trial words to be used in the search for that encoding the analog signal sample $V_{in}(t_n)$.

The DAC generates an output voltage representing the difference between the analog value which corresponds to its input, and $V_{in}(t_n)$. Such a voltage is sent to a comparator where, by comparison with the ground potential, its sign is established 10 . The digital output of the comparator, acting as an input to the SAR, determines the next word to be tried during the encoding procedure, which carries on until the DAC output becomes smaller than the least significant bit of the enconding word.

When such a situation is achieved, the content of the SAR represents the encoded version of $V_{in}(t_n)$. Such a word is then loaded into the output register, from which it is serially transmitted at the system rate of 2Mbit/sec.

3. SYSTEM TIMING

A schematic representation of the CODEC timing is shown in fig. 2. It basically consists of the following input signals. The master clock (MCK) which is used for generating the internal timing of the circuit, and is completely independent of the transmit (TXCK) and receive (RXCK) clocks. The latters determine the transmit and

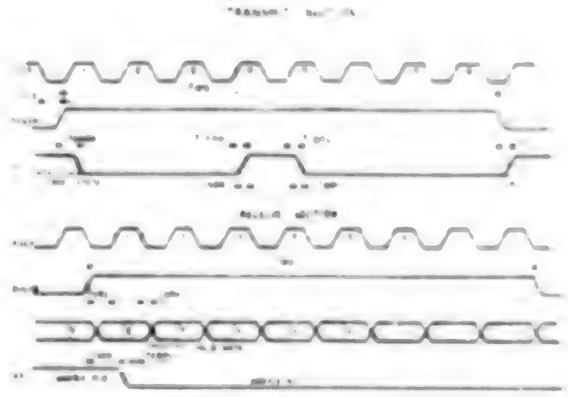

Fig. 2 - Timing diagram of the system.

receive rates, respectively, and are in turn completely asynchronous one with respect to the other. Their frequency may be as large as 2.1 MHz. Two additional timing signals are the transmit (TXSYN) and receive (RXSYN) synchronisms, which are used to enable the output and input registers, respectively.

In particular, the encoded word is transmitted when both TXSYN and TXCK are high. For the former this occurs for a period 8 times longer than for the latter so that, when TXSYN is high, a bit is actually transmitted at each period of TXCK. Instead, when TXSYN is low, the three state CODEC output is in the high impedance condition. The same holds for RXSYN and RXCK in the receive section.

4. THE CONVERSION LAW

The A conversion law used in the European PCM systems, and implemented in the present CODEC, is shown in figure 3. It uses 8 bit words, consisting of a sign bit and 7 magnitude ones. These latters are further divided in two parts: the first three of them are, in fact, devoted to encode the chords of the conversion law (which are actually 7, but the first has to be thought as subdivided in two equal parts) while the remaining 4 identify one of the 16 equal steps in which each chord is partitioned.

The exponentially increasing size of the chords gives rise to a compressed conversion law allowing higher ADC resolution at low analog-signal levels and, therefore, lower quantization noise than achievable by means of a linear code with the same number of bits. In our case, in fact, the least significant bit of the A law just described corresponds to that of an 11 bit linear encoding law.

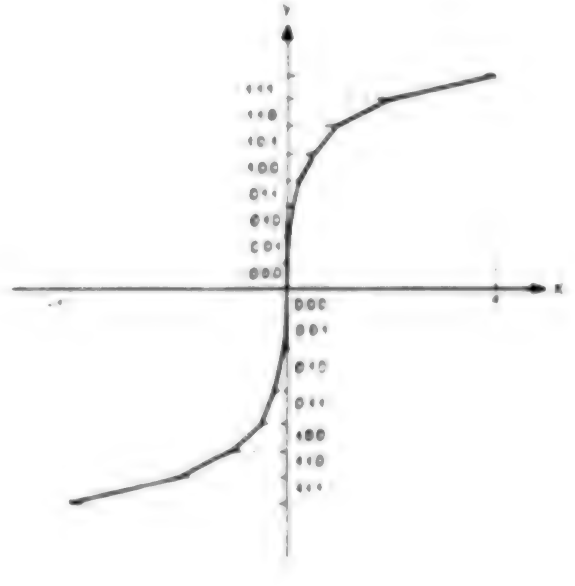

Fig. 3 - The A-compression law.

5. CIRCUIT DESCRIPTION

a) The digital-to-analog converter (DAC).

The circuit performing the conversion from digital to analog signals is implemented, in the transmit section of the prsent CODEC, by means of the weighted capacitor ladder shown in figure 4a. It consists of two sections of 6 bits each connected by a 64:1 capacitor divider and has a digital input in the form of a sequence w_i of bits selecting the position of the various switches (when $w_i = 0$, the i^{th} switch is at the ground position while for $w_i = 1$ it either goes to $+V_{ref}$ or $-V_{ref}$, according to the sign of the sampled signal). The analog output is available at node 0 and is sent to the op-amp in the unity-gain configuration.

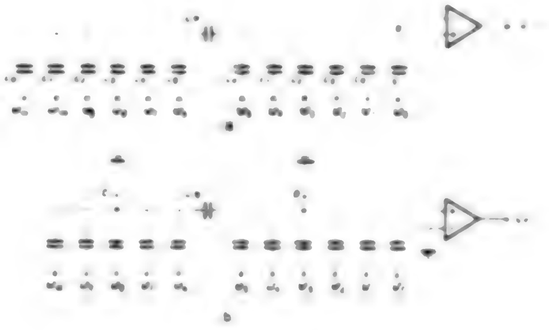

Fig. 4 - Block diagram of the digital to analog converter: (a) receive section, (b) transmit section.

The circuit exploits the principle of charge redistribution 11 essentially working as a voltage divider and, being linear, superposition of effects leads to the following output voltage

$$(1) \qquad V_{out} = \pm V_R \left(\sum_{i=0}^{11} w_i 2^{-(i+1)}\right)$$

provided $C_i = 2^i \cdot C_o$, and $C_r^{-1} = C_0^{-1} - \left(\sum_{i=0}^{5} C_i\right)^{-1}$.

Equation (1) exploits a resolution corresponding to half the least significant bit of the A law, which is necessary to fulfill the requirement of an output voltage intermediate between the two extremes of the step identified by the 8-bit digital word.

In the transmit section, instead, the DAC requires only a resolution corresponding to the least significant bit of the A law, because the real decision levels are to be implemented here. Consequently, one of the two capacitors $C_5 = 2^5 C_0$ can be omitted, with appreciable area saving. The circuit, represented in figure 4b, operates as follows. At the beginning all the w_i switches are turned to V_{in} with the upper capacitor plates at ground potential. The charge $C_{tot} \cdot V_{in}$ is therefore stored. Then M1 and M2 are switched off and the amount of charge stored on the nodes O' and O can no longer be changed. The w_i switches are subsequently thrown to ground, so that the potential at nodes O' and O becomes $- V_{in}(t_n)$, thus allowing the comparator to identify the sign bit. Finally, the successive approximation procedure is initiated and, at each step, the output voltage is given by

$$(2) \qquad V_{out} = - V_{in}(t_n) \pm V_R \left(\sum_{i=0}^{10} w_i \, 2^{-(i+1)} \right)$$

Making use of a suitable strategy, 7 trials are enough to determine the encoded digital word.

The DAC layout is represented in figure 5. For the top capacitor plate a highly doped polycrystalline silicon layer is used, whereas the multiple bottom plates are obtained by a high-dose P^{31} implant providing a negligible voltage coefficient. Each individual capacitor is obtained as a parallel combination of multiple elementary capacitors with the same geometry. Each of them contains an equal number of convex and reentrant angles, so that the capacitance ratios precisely correspond to their nominal values. Such an accuracy is essential in order to keep signal-to-noise ratio and gain tracking as close as possible to their theoretical values.

b) The expander

As already pointed out, the scope of this circuit is a conversion from the A law to a linear code. The 7 magnitude encoding bits are thus translated into an 11 or 12 bit word to be used for driving the DAC's. The circuit used, shown in figure 6, is given by a tree-like structure essentially establishing suitable connection paths between the 7 input and the 11 or 12 output bits. The most remarkable feature of such an expander is that it does not lead to any appreciable power dissipation.

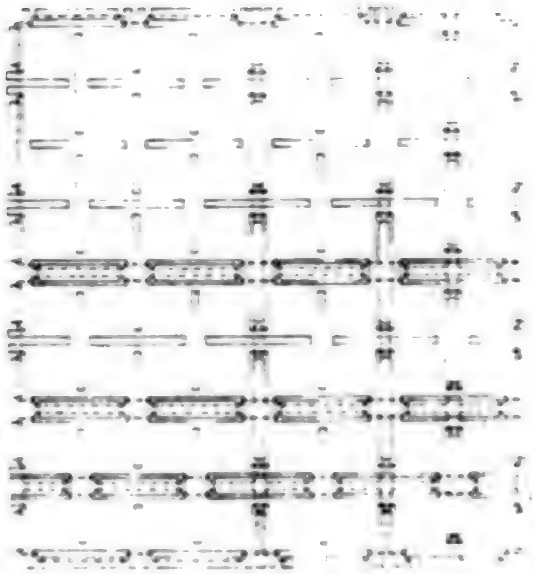

Fig. 5 - DAC layout.

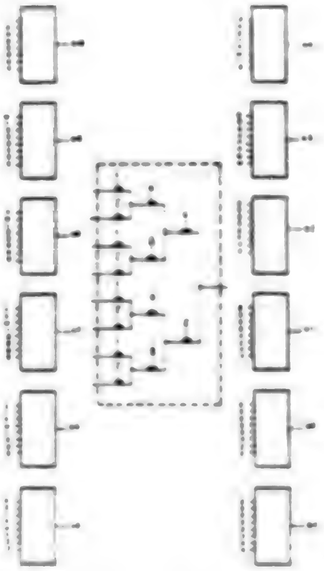

Fig. 6 - Expander.

The circuit is used in both the receive and transmit sections, the only difference being an additional output w_{11} and the value of the K input which is set to 1 in the digital to analog conversion for adding an extra half step to the analog output. The latter lies then in the middle of the various decision levels shown in figure 3.

c) The successive approximation register (SAR)

The strategy chosen for the search of the digital word encoding the analog signal sample

$V_{in}(t_n)$ requires a number of trials equal to the word length.

With reference to the chords encoding bits (b_1-b_3), this is achieved by starting the search with the 5th word represented in table I, while keeping b_4 - b_7 at their 0 value. The comparator then evaluates the DAC output V_{out} if $V_{out} > 0$, then $|V_{in}(t_n)| < V_4$ (where V_4 represents the lower boundary of the 5th chord) and therefore b_1 is set to 0 as made clear by table I. Of course, the opposite holds true if $V_{out} < 0$; thus, the first trial unambiguously determines b_1. The same procedure is then applied for determining b_2. Supposing $b_1 = 0$, the word to be tried is the 3rd represented in table I, and the comparator output then discriminates the relative magnitude of $|V_{in}(t_n)|$ with respect to the lower boundary of the 3rd chord. So doing, b_2 is determined, and the procedure is successively carried out for all the remaining bits.

TABLE I

Chord	Encoding bits		
	b_1	b_2	b_3
8th	1	1	1
7th	1	1	0
6th	1	0	1
5th	1	0	0
4th	0	1	1
3rd	0	1	0
2nd	0	0	1
1st	0	0	0

The circuit used to implement such a strategy consists of 7 identical blocks containing a set-reset flip-flop providing the output, and some circuitry for interpreting the response of the comparator. Initially, the fifth flip-flop is set to 1 with the others at 0. The comparator output either confirms of reverses the flip-flop content. Once this operation is completed, the next flip-flop is set to 1 and the procedure iterated.

d) Operational Amplifier

The operational amplifier scheme is represented in fig. 7: it essentially includes two amplification stages followed by a unity-gain buffer with large bandwith and small output impedance.

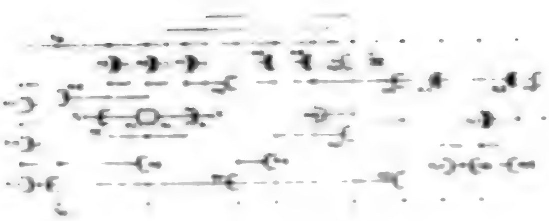

Fig. 7 - Operational amplifier.

The first stage, consisting of transistors M1-M8, is a basic differential amplifier of the type described in 12 followed by a level shifter M11, M12. The aspect ratio of the input transistors M1, M2 is twice that of M3, M4 so that, for small differential input voltages, the source of M6 is typically at the quiescent output voltage of the differential amplifier. The feedback loop M8-M10 assures the stability of the operating point against process variations, whereas the voltage reference generator M13-M15 has been chosen in such a way as to allow for a variable common-mode range, following variations in supply voltage.

The second gain stage M16-M21 represents a modification of the usual cascoded inverting amplifier. M19 is the load device, while M17 provides a constant component of drain current for M16, which raises its transconductance without raising the current which flows in M18 and M19. The inverting amplifier M20, M21 assures the stability of the M17 source voltage over a wide range of operating conditions, thus forcing the full signal current through the load M19 with an increased voltage gain.

The compensation capacitance $C_c = 1.6$ pF is connected to the source follower M22, M23, to avoid the feedforward effect from the first to the second amplifying stage 13 .

The output buffer M24-M29 is a shunt-feedback stage of the type described in 14 with a gain of 0.85 and a bandwith of 5 MHz using a capacitive load of 20 pF.

The overall voltage gain of the operational amplifier is 60 dB; its gain-bandwith product is 3 MHz, and the slew-rate is 7 V/µsec. (both positive and negative). The small value of the compensation capacitor allows a total area of only 0.15 mm^2. Power consumption, mostly concentrated in the output buffer, is about 10 mW with ± 5 V supplies.

e) Comparator.

The most important requirement of the MOS comparator in a telephone CODEC is that of a low-offset voltage, because the smallest A/D conversion level is only about 1.2 mV in the A--law. The use of offset-nulling techniques makes this specification feasible with the MOS technology 11.

The block diagram of the comparator is shown in fig. 8. It essentially consists of

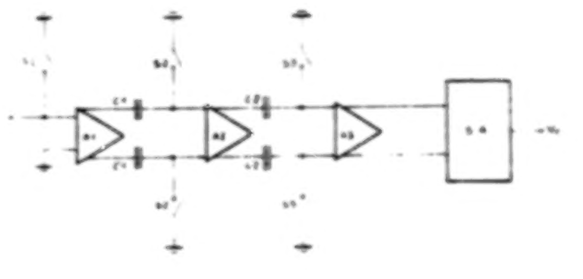

Fig. 8 - Comparator

three differential amplifying stages followed by a sense amplifier.

To operate the circuit, first all the switches are closed; the offset of A_1 is charged on the pair of capacitors C_1, and that of A_2 similarly on the C_2 capacitances. Subsequently S1 is opened, and the voltage change of the input node due to switch non-idealities is additionally charged on the C_1 pair. S2 and S3 are finally opened, thus allowing the comparator to detect any voltage change at the input.

The large gain of the cascaded amplifier stages (about 30.000) usually allows the last stage to be fully saturated. However, due to the non-zero probability of an imperfect unbalancing, and to the non-logical low level of a differential stage, a static sense amplifier has been introduced at the output.

The circuit layout has been designed fully symmetric, in order to reduce the sensitivity to supply voltages and clock coupling. An input offset of less than 100 μV has been measured in the realized devices.

6. CIRCUIT PERFORMANCE

The signal-to-noise ratio achieved by the present CODEC is represented vs the analog input level in figure 9, along with the mask representing minimum performance according to the CCITT specifications.

For this measurement standard R-C active PCM filters realized in hybrid technology have been used. The experimental curve is shown to exceed the CCITT requirements by at least 2 ÷ 3 dB over the whole range of input signals, extending up to - 55 dBm0.

The gain tracking curve is shown in figure 10, again with the mask representing the maximum allowable variation of the CODEC gain. Experimental points exhibit a nearly flat behaviour up to - 55 dBm0, and fall well within the allowable range of variation.

In addition, the DC values of analog output levels of the CODEC receive section have been carefully measured using a 16 bit A-D converter. The maximum deviations with respect to the nominal output values usually fall within 1/4 of the least significant bit, showing the remarkable accuracy achieved by the capacitive DAC.

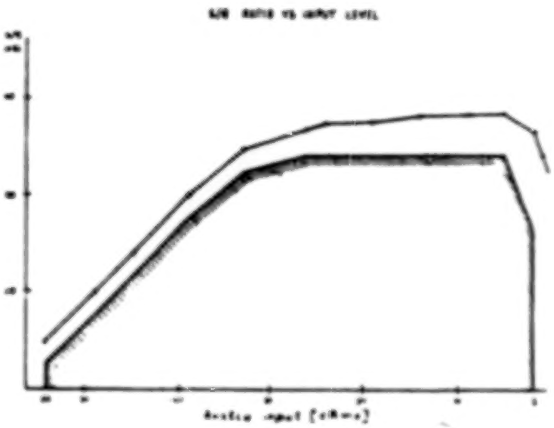

Fig. 9 - Signal-to-noise ratio vs analog input level.

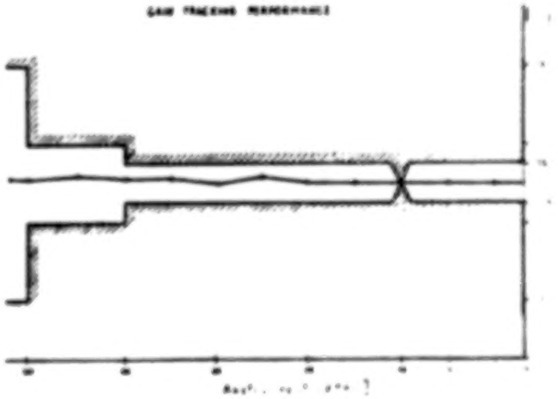

Fig. 10 - Gain tracking vs. analog input level.

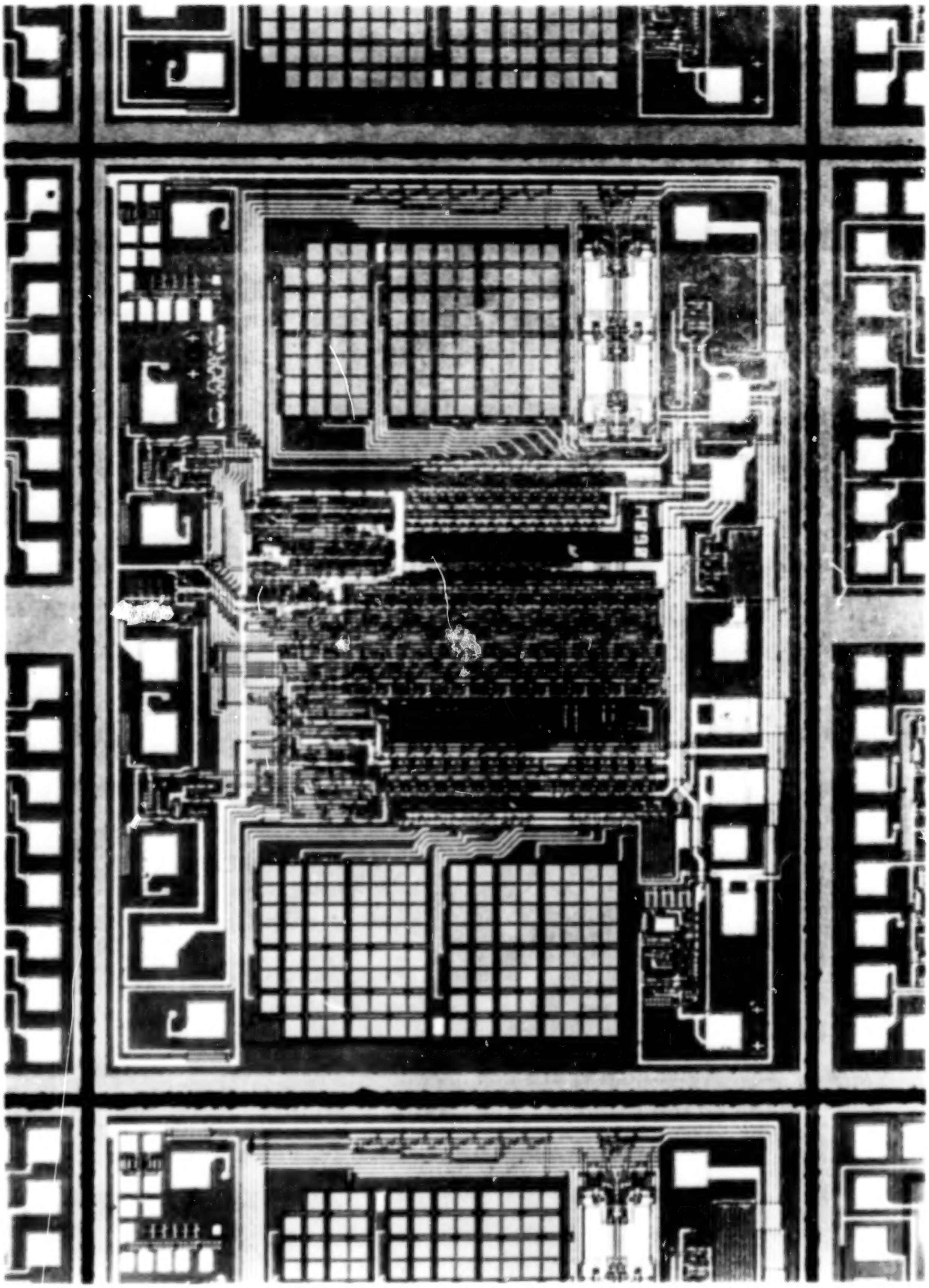

Fig. 11 - Chip microphotograph

7. CONCLUSIONS

A new PCM per-channel CODEC has been designed and fabricated using a standard n-MOS technology. The resulting chip size is 12 mm^2 thus allowing high yield and low cost. Power consumption has been kept within reasonable limits (70 mW typical) implementing the expander with a transmission gate chain consuming no d.c. power and carefully designing the linear cicuits As with regard to these, original solutions have been adopted to stabilize the quiescent voltages in the high gain cascoded stage of the op-amp against undesired variation of the process parameters and for timing the comparator so as to cancel out to a large extent both the differential stage off-set and the switches non idealities. The fully-capacitive DAC is shown to provide accurate analog levels, and the circuit performance exceeds the CCITT specifications.

The chip microphotograph is shown in figure 11.

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